

Remarks

Claims 15-19 and 30-36 are pending. Favorable consideration is respectfully requested.

Applicants wish to express their appreciation to Examiner Tsoy Lightfoot for her careful review of the wording of the claims. Claim 32 has been amended to correct "R⁷" to "R¹", and the same change has been made to claim 19. Claims 32-36 have been amended to recite "the partly hydrophobic silica particles" rather than the "composition". The claims were examined on the basis of the former language (Office Action, page 3). Withdrawal of all of the claim rejections under 35 U.S.C. § 112, ¶¶ 1, 2, is respectfully solicited.

The claims continue to be rejected under 35 U.S.C. § 103(a) over Barthel et al., U.S. 5,686,054 ("*Barthel*") and over Tojo et al., U.S. 5,278,204 ("*Tojo*"). Applicants respectfully traverse these rejections for the reasons previously given, which are incorporated herein by reference. Applicants wish in particular to briefly discuss the references, in view of the examples/comparative examples set forth in the response of June 15, 2007 and additional examples/comparative examples as set forth herein. All these results are presented in the form of the Declaration of Dr. Torsten Gottschalk-Gaudig.

With respect to *Barthel*, the position of the Office appears to be that if the same type of silylating agent within the range disclosed by *Barthel* is used to silylate a silica of a specific surface area, the result must be the same. However, as clearly discussed previously, this is not the case. Silica of 200 m²/g surface area, for example, may be prepared by numerous variations of pyrogenic silica manufacture, and may have distinctly different surface silanol content. Also, the conditions of silylation may be different as well, as can be the silylating agent.

One skilled in the art recognizes that there is no direct relationship between the amount of silylating agent, the silica surface area, the methanol number, and the carbon content.

One cannot, for example, create a mathematical relationship which would allow one to input three of those four variables (there are more) and calculate the remaining one.

The Office appears to be missing the fact that *Barthel* is only directed to highly, virtually completely hydrophobicized silica having a methanol number of 50 or more, preferably more. Regardless of whether one could choose a type of silylating agent, an amount of silylating agent, the silylation conditions, the silica surface area, the silica preparation method, etc., to create a partly hydrophobic silica having the claimed methanol number of less than 30, *Barthel* teaches not to do so, but to instead select the above variables such that a methanol number ≥ 50 is achieved. *Barthel* teaches away from producing silica with methanol numbers < 50 . Teaching away is strong evidence of non-obviousness. *W.L. Gore v. Garlock*, 220 USPQ 303 (Fed. Cir. 1983).

The examples set forth in the specification are summarized in the table on the next page. These are Examples 1-5. Also in the table are additional examples and comparative examples performed under the direction of Dr. Torsten Gottschalk-Gaudig, and a *Barthel* example and comparative example. The *Barthel* requirements for his fully hydrophobicized silica and the claimed silica are also set forth in the table. In the table, the various silylating agents are as follows:

DMDCS	dimethyldichlorosilane
HMDS	hexamethyldisilazane
OH-PDMS	hydroxyl-terminated-polydimethylsiloxane
MTCS	methyltrichlorosilane
TMES	trimethylethoxysilane.

Both HMDS and TMES result in formation of $(\text{CH}_3)_3\text{Si-O}$ groups on the silica surface by reaction with surface silanol groups, and thus the silicas produced using these two different silylating agents will be derivatized in the same manner.

The details of the additional examples/comparative examples are as follows. The details for Examples 1-5 may be found in the specification.

Example 6 (according to the invention)

At a temperature of 25°C and under N₂ inert gas, 100 g of hydrophilic silica with a moisture content of less than 1%, an HCl content of less than 100 ppm, and with a specific surface area of 200 m²/g (measured by the BET method in accordance with DIN 66131 and 66132) available under the name HDK[®] N20 from Wacker-Chemie AG, Munich, Germany, are mixed by atomization through a one-fluid nozzle (pressure: 5 bar) with 2.56 g of a mixture of 0.56 g of H₂O and 2.0 of MeOH and 4.29g of dimethyldichlorosilane. The silica thus loaded is reacted at 250°C in a 100 L drying cabinet under N₂ for a residence time of 2 h. The analytical data are listed in the Table.

Comparative Example C1 (non-inventive; aim:
same carbon content as Example 1 but different silica)

At a temperature of 25°C and under N₂ inert gas, 100 g of hydrophilic silica with a moisture content of less than 1%, an HCl content of less than 100 ppm, and with a specific surface area of 100 m²/g (measured by the BET method in accordance with DIN 66131 and 66132) available under the name HDK[®] N10 from Wacker-Chemie AG, Munich, Germany, are mixed by atomization through a one-fluid nozzle (pressure: 5 bar) with 2.56 g of a mixture of 0.56 g of H₂O and 2.0 g of MeOH and 4.29 g of dimethyldichlorosilane. The silica thus loaded is reacted at 250°C in a 100 L drying cabinet under N₂ for a residence time of 2 h. The analytical data are listed in the Table.

Example 3 (non-inventive; aim:
same carbon content as Example 1 but different organosilicon compound)

At a temperature of 25°C and under N₂ inert gas, 100 g of hydrophilic silica with a moisture content of less than 1%, an HCl content of less than 100 ppm, and with a specific

surface area of 200 m²/g (measured by the BET method in accordance with DIN 66131 and 66132) available under the name HDK[®] N20 from Wacker-Chemie AG, Munich, Germany, are mixed by atomization through a one-fluid nozzle (pressure: 5 bar) with 8.21 g of a mixture of 1.79 g of H₂O and 6.42 g of MeOH and 9.90 g of methyltrichlorosilane. The silica thus loaded is reacted at 250°C in a 100 L drying cabinet. The analytical data are listed in the Table.

Example 7 (2.1 parts of silylating agent)

At a temperature of 25°C and under N₂ inert gas, 100 g of hydrophilic silica with a moisture content of less than 1%, an HCl content of less than 100 ppm, and with a specific surface area of 200 m²/g (measured by the BET method in accordance with DIN 66131 and 66132) available under the name HDK[®] N20 from Wacker Chemie AG, Munich, Germany, are mixed by atomization through a one-fluid nozzle (pressure: 5 bar) with 0.35 g of H₂O and 2.10 g (*i.e.* 2.1 parts with respect to silica; 0.09 mmol/g per 100 m²/g silica of trimethylsiloxy groups) of trimethylethoxysilane. The silica thus loaded is reacted at 200°C in a 100 l drying cabinet under N₂ for a residence time of 2 h. The analytical data are listed in Table 1.

Comparative Example C3 (2.1 parts of silylating agent)

At a temperature of 25°C and under N₂ inert gas, 100 g of hydrophilic silica with a moisture content of less than 1%, an HCl content of less than 100 ppm, and with a specific surface area of 100 m²/g (measured by the BET method in accordance with DIN 66131 and 66132) available under the name HDK[®] N20 from Wacker Chemie AG, Munich, Germany, are mixed by atomization through a one-fluid nozzle (pressure: 5 bar) with 0.47 g of H₂O and 2.10 g (*i.e.*, 2.1 parts with respect to silica; 0.18 mmol/g per 100 m²/g silica of trimethylsiloxy groups) of hexamethyldisilazane. The silica thus loaded is reacted at 80°C in a 100 l drying cabinet under N₂ for a residence time of 2 h and then cleaned from by-products at 150°C for 1 h. The analytical data are listed in the Table.

Comparative Example C4 (2.1 parts of silylating agent and lower BET surface area)

At a temperature of 25°C and under N₂ inert gas, 100 g of hydrophilic silica with a moisture content of less than 1%, an HCl content of less than 100 ppm, and with a specific surface area of 100 m²/g (measured by the BET method in accordance with DIN 66131 and 66132) available under the name HDK[®] C10 from Wacker Chemie AG, Munich, Germany, are mixed by atomization through a one-fluid nozzle (pressure: 5 bar) with 0.35 g of H₂O and 2.10 g (*i.e.*, 2 parts with respect to silica; 0.09 mmol/g per 100 m²/g silica of trimethylsiloxo groups) of trimethylethoxysilane. The silica thus loaded is reacted at 200°C in a 100 l drying cabinet under N₂ for a residence time of 2 h. The analytical data are listed in Table 1.

Table 1

Example	Silica Surface Area (m ² /g)	Silylating Agent, wt. %	Carbon Content wt. %	% SiOH	Water Wettable?	Methanol Number
1	200	2.86 DMDCS	0.56	80	yes	0
2	300	2.67 HMDS	0.95	82	yes	5
3	150	1.33 HMDS	0.41	74	yes	15
4	200	1.00 OH-PDMS	0.35	94	yes	0
5	200	2.00 OH-PDMS	0.61	84	yes	0
6	200	2.56 DMDCS	0.82	71	yes	0
C1	100	2.56 DMDCS	0.85	43	no	45
C2	200	9.90 MTCS	0.81	48	no	40
7	200	2.10 TMES	0.54	72	yes	0
C3	100	2.10 HMDS	1.13	55	no	43
C4	100	2.10 TMES	0.58	44	no	52
Barthel 1	200	32 DMDCS	3.0	Not Detectable	no	55
Barthel 2 (Comparative)	200	32 DMDCS	1.5	Detectable	no	40
Subj. Inv.	25 - 500	0.015 - 0.15 mmol/g	> 0 to 2.0	Surface Silanol 0.9 - 1.7 SiOH/nm ²	yes	≥ 30

Barthel	25 - 400+	2 - 100 wt. %	> 1 to 2+	0 (col. 1, ll. 44-49)	no	> 50
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The conclusions which can be drawn from the table are evident. For example, it is clear that there is no relationship between carbon content and methanol number. Looking at Examples 2 and 3, the same silylating agent was used. Since the silica of Example 3 had only half the specific surface area of the silica of Example 2, half the amount of silylating agent was used. However, neither the surface silanol content nor the methanol numbers are similar. Example 2 contained 0.95% carbon and had a methanol number of 5, while Example 3 had a carbon content of 0.41% and a higher methanol number (more hydrophobic).

Examples 6 and 1 employed the same silica, 200 m²/g surface area, and the same hydrophobicizing agent, dimethyldichlorosilane. Example 6 employed slightly less silylating agent than Example 1, yet had a considerably higher carbon content, and less surface silanol content. Both silicas had a methanol number of zero.

Example 7 and Comparative Example C4 employed the same silylating agent, in the same amounts. Only the silica particle size is different. Comparative Example C4 meets *Barthel's* requirement of a methanol number ≥ 50 , but Example 7 does not. Rather, it has a methanol number of zero, meeting Applicants' claim limitation of a methanol number < 30 . Note that the carbon content of both silicas is similar.

All the subject invention examples employ relatively low amounts of silylating agent, between 0.015 and 0.15 mmol/g per 100 m²/g of silica surface area, which is an important claim limitation. Each example had a low methanol number, most of them zero, while the carbon content fluctuated between 0.35 weight percent and 0.95 weight percent. Contrast these with the silicas of *Barthel*. The Barthel 1 silica (Example 1 of *Barthel*) and the comparative example (Comparative Example 2 of *Barthel*) both employed the same silica, with identical surface area (200 m²/g), the same silylating agent (dimethyldichlorosilane), and the same amount of silylating agent (32 weight percent). Yet the silicas had quite different properties. The Barthel 1 silica (his

inventive silica) had no detectable surface silanol groups (IR band, DRIFT), while the comparative example did. Also, despite the same amount of silylating agent having been added, the comparative silica had half the carbon content (1.5 weight %) than the inventive silica (3.0 weight %). These experiments from the prior art make clear what Applicants have stated earlier. Merely because the same amount of silylating agent is used, with the same silica, there is still no relationship between these facts and the silanol content or methanol number, or even the carbon content. In this case, one silylation was performed initially at a low temperature using a mist of silylating agent, while the other employed a higher temperature with the silylating agent in gaseous form.

Thus, the Office's conclusions that:

Clearly, the degree of hydrophobicity of silylated silica would depend upon the amount of silylating agent

is incorrect. *Barthel*'s own examples bear this out. *Barthel* does not teach or suggest using a low amount of silylating agent to obtain a silica having a methanol number < 30. He does teach using an amount of silylating agent (a very large amount, generally) to obtain a silica having a methanol number ≥ 50 .

The fact that one could pick and choose from among the many independent variables disclosed by *Barthel* and thereby produce a subject invention silica having a methanol number < 30 is irrelevant to patentability. *Barthel* teaches against doing so. He proposes wide ranges of variables to take into account the differences between, *inter alia*, silica specific surface area; number of surface silanol groups (in SiOH/nm²) of a silica with a defined surface area; type and reactivity of silylating agent; molecular weight of silylating agent; loading temperature of silylating agent; loading method for silylating agent; reaction temperature and duration of reaction for silylation; continuous or stepped reaction temperature; post-treatment of silylated silica; addition or non-addition of co-reactants (*e.g.*, water, methanol); amount of co-reactants, etc. Of all these variables, there is absolutely no direction provided by *Barthel* to choose parameters which would not work to make his silica: completely hydrophobicized silica with

no detectable surface silanol groups, having a methanol number ≥ 50 . *Barthel* teaches away from the claimed invention. Withdrawal of the rejection over *Barthel* is respectfully solicited.

Claims 15-19 and 30-36 have been rejected under 35 U.S.C. § 103(a) over *Tojo*. Applicants respectfully traverse this rejection.

As indicated previously during prosecution of this application, *Tojo* does not disclose, teach, or suggest the claimed partly hydrophobic silicas. In assessing the issue of obviousness over the prior art, it is well-established that the claim must be viewed as a whole. Claim 15 contains numerous claim limitations, of which the most important ones, for the purposes of this discussion, are as follows:

- (1) contact angle $\theta < 180^\circ$;
- (2) degree of coverage $1\% < \tau < 50\%$;
- (3) density of surface silanol groups ≥ 0.9 and ≤ 1.7 SiOH/nm²;
- (4) carbon content > 0 and less than 2 wt. %;
- (5) methanol number < 30 ;
- (6) amount of silylating agent 0.015 to 0.15 mmol/g per 100 m²/g silica surface area.

All these requirements must be simultaneously met. *Tojo* discloses and/or discusses only two of these six limitations in some manner or other:

- (3) amount of surface silanol groups, and
- (4) carbon content.

With respect to limitation (3), the only reference to silanol content in *Tojo* reads as follows:

Among various silica type fillers, dry method silica has a relatively low silanol group content, and if this silica is treated with the above-mentioned silane, the silanol group is blocked and it is considered that the silica is effectively bonded to the rubber by the functional group of the silane.

Tojo, column 5, lines 10-15 (emphasis added). There is no other reference to silanol groups in the entire *Tojo* specification, and this sole passage indicates blockage of the silanol groups, *i.e.*, a surface silanol group content of 0 SiOH/nm². Applicants' claims require 0.9 to 1.7 SiOH/nm². Thus, this limitation is not disclosed by *Tojo*.

With regard to limitation (4), *Tojo* discloses carbon contents of 0.1 to 5% by weight, preferably 0.5 to 4%, and especially preferably 1 to 3% by weight (col. 5, lines 16-20). Thus, the range disclosed by *Tojo* encompasses Applicants' claimed range of > 0 and less than 2 weight %. This is the only one of the six limitations listed above which is disclosed by *Tojo*. However, as indicated previously, there is no direct relationship between this variable and methanol number, silanol content, etc.

When a reference does not disclose or suggest one or more claim limitations, the claimed invention cannot be rejected over the reference unless the remaining claim limitations are inherent. This has been the law for many years. However, for inherency to apply, the rejection must be for anticipation under 35 U.S.C. § 102, and the inherent feature relied upon must be a certain and necessary result, *i.e.*, one which occurs of necessity, 100% of the time, and not just a possibility or even a probability. *See, e.g., Ex parte McQueen*, 123 USPQ 37 (POBA 1958); *Ex parte Cyba*, 155 USPQ 756 (POBA 1966); *Ex parte Keith*, 154 USPQ 320 (POBA 1966); and especially *In re Robertson*, 49 USPQ2d 1949 (Fed. Cir. 1999).

Inherency is immaterial to a rejection for obviousness under 35 U.S.C. § 103. If the reference does not disclose, teach, or suggest even a single claim limitation, this limitation cannot be supplied based on surmise, *i.e.*, that it may occur or even probably will occur. These are arguments based on inherency, and as stated, inherency is immaterial to obviousness. *See, e.g., In re Shetty*, 195 USPQ 753 (CCPA 1977); *In re Naylor*, 152 USPQ 106 (CCPA 1966); *In re Spormann*, 150 USPQ 449 (CCPA 1966); *Jones v. Hardy*, 230 USPQ 1021, 1025 (Fed. Cir. 1984).

Here, this is just the argument made by the Office. The rejection is for obviousness under 35 U.S.C. § 103(a). The Office first postulates the following statement:

In other words, some silica treated by the method of Tojo would be substantially identical to that of the claimed invention and some of the treated silica would not be substantially identical to that of the claimed invention.

This statement alone is clear evidence that the silica of *Tojo* does not inherently possess Applicants' claim limitations.

In an attempt to escape the rigors of the doctrine of inherency, the Office states, without legal support, that "the 102 principles of inherency was not applied." However, inherency was applied. The only way a rejection can be made over a prior art reference which does not disclose a claim limitation is under principles of inherency, and as stated in *In re Evanega*, 4 USPQ2d 1249 (Fed. Cir. 1987), when evaluating obviousness, all claim limitations must be evaluated, and must be disclosed, taught, or suggested by the reference:

In this respect, the mere absence from the reference of an explicit requirement of the claim cannot reasonably be construed as an affirmative statement that the requirement is in the reference.

Evanega at 1251. In other words, since *Tojo* does not disclose five of the six limitations discussed, it cannot be assumed that these limitations are met.

The Office cites *In re Malagari*, 182 USPQ 549 (CCPA 1974), as standing for the proposition that "it is well settled that overlapping ranges are *prima facie* evidence of obviousness." As a broad statement, this is incorrect. Moreover, *Malagari* does not apply in the present case.

In *Malagari*, the invention was directed to a ten step process for preparing grain-oriented silicon steel for use in transformer cores and motor cores, the steels produced by

the claimed process characterized in lower hysteresis loss and higher magnetic permeability. The claims were rejected under 35 U.S.C. § 103 over the *Goss* reference. *Goss* unambiguously disclosed every claim limitation except one. In that limitation, the first step of the claimed process, steel which contained from 0.03 to 0.07 weight % carbon is heated. *Goss* disclosed 0.02 to 0.03% carbon in an otherwise identical step.¹

Thus, unlike the present case, where there are many limitations, including the six discussed here, in *Malagari* there was only a single limitation not explicitly disclosed by the prior art, a range of 0.03 to 0.07%, but the lower end of which range touched the high end of the reference's range. When there are multiple limitations claimed, meeting only one such limitation by means of an overlap of ranges is not sufficient, and does not create a case of *prima facie* obviousness. All limitations must be met. This case is completely different from that in *Malagari*, and *Malagari* does not apply.

Moreover, as the examples and comparative examples show, with respect to the carbon content, merely because the prior art is within the claimed range does not imply that the remaining claim limitations are met. For example, the table on page 10 clearly indicates that there is no direct relationship between carbon content and any of the remaining properties.

Finally, it must be noted that even if the broad ranges of *Tojo*'s silica specific surface area, carbon content, etc. would allow the preparation of a silica meeting all of Applicants' claim limitations, *Tojo* provides no teaching or suggestion, no direction, no motivation to produce a silica which is only partly hydrophobicized and still contains large amounts of silanol groups. It is Applicants who teach doing so, not *Tojo*. Applicants did so to provide silica particles with surfactant-like behavior, a problem not discussed by *Tojo* and not remotely relevant to any of *Tojo*'s rubber compositions. There must be some teaching or suggestion in the reference to do as Applicants have done. *Tojo* has none, and the Office has not pointed to any such teaching or suggestion. *See, e.g., Ex parte Kuhn*, 132 USPQ 359 (POBA

¹ Under present law, the claim would have been anticipated since the endpoint of the *Goss* range and the claimed range are the same.

1961), where the Board stated that although the inventor (Kuhn) was working within the broad range of the prior art, it was improper to reject the claims over the art when to arrive at the claimed invention would require selecting specific items and conditions from the prior art, when the reference failed to give some directions or reasons for making the selection.

Finally Applicants note that the silylating agents of *Tojo* are very specific, in order that these might adhere to or bond with the rubber matrix. In order to do so, the silylating agents must have alkenyl, chloroalkenyl, or chloroalkyl functional groups to react with the diene rubber.

Claim 16 requires the silylation to be performed with an organopolysiloxane. This is not optional in claim 16; it is required. *Tojo* employs only silanes, not organosiloxanes, and does not teach or suggest using these silylating agents. Claim 16 is separately patentable.

Claim 18 requires hydrosilylation with both a silane and an organosiloxane. *Tojo* does not teach or suggest this. Claim 18 is separately patentable.

Claim 19 requires that the silane of claim 17 have R¹ groups selected from the group consisting of the enumerated alkyl, aryl, and alkylaryl radicals. *Tojo* requires an alkenyl radical, a chloroalkenyl radical, or a chloroalkyl radical. In column 1, *Tojo* cites prior art silicas which have been silylated with trimethylchlorosilane, and indicates that these silicas are not acceptable in diene rubber. *Tojo* does not teach or suggest the subject matter of claim 19, which is separately patentable.

Claim 33 requires the silylation to be performed with one or more silanes selected from the group consisting of methyltrichlorosilane, dimethyldichlorosilane, trimethylchlorosilane, or hexamethyldisilazane. None of these bear *Tojo*'s required functional groups, and none are taught or suggested by *Tojo*. Claim 33 is separately patentable. Applicants do not understand the comment of the Office relative to this claim as set forth at the bottom of page 5 of the Office Action. All of the compounds of claim 33 are silanes, as are also the compounds of claim 17, which are required ("silylating is performed"), not optional.

Withdrawal of the rejections of the claims over *Tojo* is respectfully solicited.

Entry of this response is respectfully solicited, as it is believed to eliminate all of the rejections under § 112, which were not previously of record; is believed to confirm patentability of the claims over the prior art; and incorporates in the form of a Declaration the examples previously presented in an earlier response. The arguments made here have been made before, are buttressed by the additional evidence submitted, but raise no new issues.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, she is highly encouraged to telephone Applicants' attorney at the number given below.

Respectfully submitted,

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